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United States Navy Humanitarian Assistance and Disaster Relief (HADR) Costs: A Preliminary Study

26 August 2015

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Abstract

Humanitarian Assistance and Disaster Relief (HADR) operations, one of the core capabilities for USN need to be studied, particularly in these times of budget cuts, realignment of forces, and restructuring of the Services. We study selected past disasters to organize their costs and propose future studies that can provide operational and financial policy recommendations that will induce efficiency and effectiveness.

Keywords: HADR, USN, cost

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Aruna received her PhD in Operations Research from Southern Methodist University in Dallas. She also has a M. A. in Mathematics, from Temple University, Philadelphia. Before NPS she worked as a consultant at MCI and taught at the Cox School of Business, SMU, where she won the best teacher award. She has over twenty years of experience teaching operations management, operations research, and mathematics courses at the undergraduate and graduate levels. At NPS She teaches mathematical modeling, for which she won the best teacher awards (Liskin and Hamming) and has advised over 99 students for 46 MBA/Masters reports. She has also advised emergency planners in preparing for disaster response. She is the founding and past president for a college (focus group) in Humanitarian Operations and Crisis Management under the flagship of academic professional society in her intellectual area of study, Production and Operations Management Society.

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Yoho has several years of experience teaching and developing master's students and executives in the U.S. and Europe in principles of supply chain management and manufacturing operations. He has served as an intelligence analyst for the U.S. Customs Service in the area of international money laundering and has worked large litigation cases representing Lloyd's of London in insurance defense. He was the National Research Coordinator for Manufacturing Skills Standards as part of an initiative funded by the United States Congress to develop national skill standards for the U.S. industrial manufacturing economic sector. He has advised U.S. and European firms for several years in the petrochemical, semiconductor, paper and pulp products, and steel industries, focusing on enabling corporate strategy by using the supply chain as a competitive weapon.

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United States Navy Humanitarian Assistance and Disaster Relief (HADR) Costs: A Preliminary Study

Introduction

The United States (U.S.) Department of Defense (DoD) does not set aside funds for disasters. The obligation of such funds is dependent on the actual occurrence of the event. However, humanitarian assistance and disaster relief (HADR) operations are now deemed as one of the core capabilities for the U.S. Navy (USN), as described in *A Cooperative Strategy for 21st Century Seapower*, and a key national strategic priority in the 2012 Defense Strategic Guidance, 2014 Quadrennial Defense Review (QDR), and 2015 National Security Strategy.

The U.S. DoD is increasingly involved in HADR missions. However, little is known about the financial implications associated with specific HADR operational activities. In order to more effectively manage resources, and provide decision-makers with a sense of how specific operational activities drive costs, more needs to be understood about recent HADR events.

The 2004 Indian Ocean tsunami, 2010 earthquake in Haiti, and 2011 Tōhoku earthquake are just three instances when the USN has been a significant relief provider following a disaster. The 2004 Indian Ocean tsunami and 2010 Haiti earthquake resulted in widespread death, destruction, and displacement of thousands of persons. The Tōhoku earthquake of 2011 in Japan was a complex crisis event that began with a 9.0 magnitude earthquake followed by a tsunami and catastrophic compromise to the integrity of a nuclear power generation facility. These events are extremely important for understanding the breadth of operations that could take place during HADR operations, as well as the magnitude of the costs associated with those operations. The USN has shown time and time again that when there are complex and overwhelming disasters, it is capable of responding with unique assets and capabilities of vertical lift, personnel with specialized skills (such as nuclear power, medicine, logistics, and engineering), and specialized equipment such as dock landing and hospital ships (Greenfield & Ingram 2011; Herbert, Wharton, & Prosser, 2012; Kaczur, Aurelio, & Joloya, 2012; Moffat, 2014; Roughhead, Morrison, Cullison, & Gannon, 2013; Ures, 2011).

The USN has diverted ships from original missions 366 times for humanitarian assistance as opposed to 22 times for combat from the years 1979 to 2000, according to the fact sheets of United States Agency for International

Development (USAID) and Center for Naval Analysis (U.S. Naval Academy, 2011). One of the important questions raised here and by others (Apte, Yoho, Greenfield, & Ingram, 2013; Roughhead et al., 2013) is whether the USN will be able to continue and sustain humanitarian operations in an environment of fiscal austerity and budget cuts. Given that the USN plays a critical role in disaster relief worldwide, it is important to understand the costs of providing response capability for two reasons. First, if for monetary reasons the USN decides to reduce its involvement, the research described in this report will be helpful in providing other national or international organizations some estimate of the costs to fill potential gaps in response capability. Second, though HADR missions have become a significant function of the USN, and there is plenty of evidence that proves the USN's willingness to provide disaster relief, in a time of limited budgets and weak economies across the world, it is essential that the USN has a concrete understanding of the costs associated with specific capabilities over time as well as the cost of economically maintaining key capabilities. The elevation of HADR operations to a core U.S. national security priority mandates a better understanding of the costs and cost drivers of HADR operations.

It is particularly prudent therefore to understand what has been spent on HADR operations in order to begin the dialogue of assessing the contribution to security. This is an even more important reason for the USN to understand its HADR costs. In this research, we study selected past disasters from the perspective of HADR operations. We provide an outline for future studies based on our expertise and existing literature.

The Disasters and the Costs

As the USN takes on a more deliberate role in formal HADR missions, the way in which it executes its operational responses will have significant impacts on budgets established for other defense and security activities. Because financial expenditures are the result of operational activities, the decisions regarding both the types of assets that will be employed and deployed during an HADR mission demand careful consideration by decision-makers at the planning and policy-making levels (Greenfield & Ingram, 2011; Herbert et al., 2012; Kaczur et al., 2012; Moffat, 2014; Ures, 2011). This study summarizes the type of expenditures associated with a specific set of HADR operations. We organize data from recent studies that have addressed the financial implications of HADR operations (Apte, 2009; Apte, 2014; Apte & Yoho, 2011, 2012, 2014a, 2014b; Apte et al., 2013; Greenfield & Ingram 2011).

Over the last five years, we have been involved in research and analysis of costs incurred by the USN to respond to natural disasters. Each of these projects utilized the HADR classification described by Apte (2009) based on speed of onset

and geographical dispersion. In this report we recap the work by Ures (2011), Herbert et al. (2012), and Moffat (2014).

For the purpose of our report, we focus on the costs associated with HADR operations for the Indian Ocean tsunami of 2004, the Haiti earthquake of 2010, and the Japan Tōhoku earthquake of 2011. We organize the work of the key research in the area by Ures (2011), Herbert et al. (2010), and Moffat (2014). Bringing together this research provides a rough order of magnitude (ROM) estimate of the costs necessary to sustain and carry forward to future disasters the level of effort provided by the USN during past HADR operations. Table 1 summarizes the key literature on USN HADR costs and the cases studied in the key literature, respectively.

Table 1. Cases Considered in the Key Literature for USN HADR Costs

Reference	Disaster studied	Costs described	Conclusion
Ures (2011)	2004 Indian Ocean tsunami, 2010 Haiti earthquake, and 2010 Pakistan floods	Estimated costs and reported costs	Identified flight operations as best and cost-effective and cost-effective capability
Herbert et al. (2012)	2011 Tōhoku earthquake in Japan	Costs of specific asset types	Identified flight operations as most expensive
Moffat (2014)	2004 Indian Ocean tsunami, 2010 Haiti earthquake, and 2011 Tōhoku earthquake and tsunami in Japan	Capability costs	Identified vessels that are capable and cost effective

The engagements of organizations that provide humanitarian assistance have significantly increased. Only a small portion of the defense budget goes towards the incremental costs of humanitarian operations. However, many costs get submerged, and hence, these costs are not transparent to the Congress of the United States (Factor, 2011). Figure 1 describes the cash flow process of the DoD.

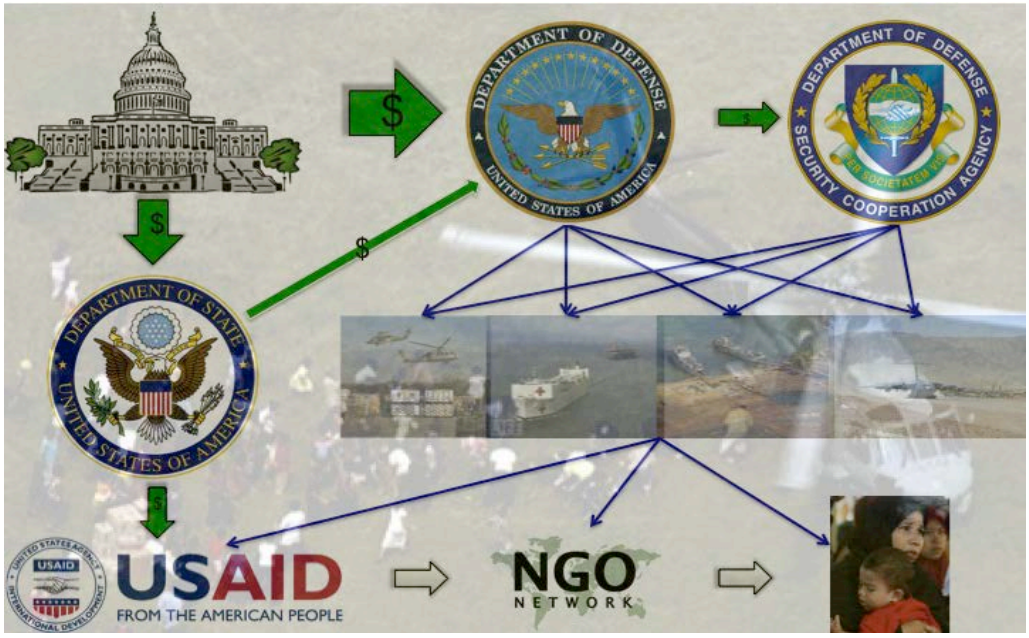

Figure 1. Cash Flow Process of DoD for Humanitarian Operations
(Ures, 2011)

We selected the disasters because of their littoral location in addition to differences in their characteristics (Apte, 2009). The 2004 Indian Ocean tsunami was a sudden disaster and dispersed since it affected many countries. The 2010 Haiti earthquake was also sudden but localized. The 2011 Japan earthquake was also sudden but morphed into a crisis. Table 2 summarizes the devastation due to these disasters in terms of deaths, injured, missing, and displaced.

Table 2. Summary of the Three Disasters

	2004 Indian Ocean Tsunami	2010 Haiti Earthquake	2011 Japan Earthquake/Tsunami
Deaths	>227,000	92,000-220,000 estimated	>14,898
Injured	>500,000	>250,000	>5,270
Missing	>2,000,000 (summary of initial reports)	>20,000	>10,000
Displaced	>1,500,000	>1,100,000	>300,000
	1. In Indonesia, more than 25% of Aceh Province's villages were destroyed	1. Destruction of all five medical facilities around Port-au-Prince	1. Meltdown of Fukushima nuclear power plant
	2. Land transportation infrastructure was almost totally destroyed on many islands throughout the Indian Ocean	2. Destruction of Toussaint L'Ouverture International Airport	2. Sendai Airport, Uranohama and Kesenumma-Oshima Seaports overwhelemed with debris
	3. Indonesia's Aceh Province lost almost all elements of local communications infrastructure	3. Considerable damage to communication infrastructure	3. Widescale power outages and destruction of hard line communications
	3. Many islands lost all electric-power production capability	4. Major damage to roadways by debris	4. Majority of small structures, personal property and lines of transportation affected area destroyed
	3. US pledged more than one third of a billion dollars to repair and replace roads and fresh water distribution systems alone	5. Major damages to the Port-au-Prince seaport, rendering it unusable for immediate rescue operations	

2004 Indian Ocean Tsunami

On December 26, 2004, an undersea earthquake of 9.1 magnitude earthquake struck off the west coast of the island of Sumatra in Indonesia. Seven days after the earthquake, the aircraft carrier USS *Abraham Lincoln* (CVN 72) was diverted from conducting a port visit in Hong Kong to the coast of northern Sumatra. The carrier had 17 embarked helicopters (Elleman, 2007). The amphibious ship USS *Bonhomme Richard* (LHD 6), with an embarked Marine Expeditionary Group and 25 helicopters, arrived five days later. The engagement of the DoD included 25 Navy

ships, one Coast Guard cutter, 82 planes, 51 helicopters, and 15,000 personnel (Elleman, 2007). The naval vessels operated as a sea base for relief efforts for 40 days. They left the affected region only to be followed by the hospital ship USNS *Mercy* (T-AH 19) and supported by helicopters from USS *Essex* (LHD 2). *Mercy* Figure 2) provided sea-based hospital services for 34 days.

Figure 2. The USNS *Mercy* and USS *Abraham Lincoln* Arrive on Station Near Banda Aceh, Sumatra, in 2004
(U.S. Navy photo by Photographer's Mate 3rd Class Gabriel R. Piper)

The incremental costs submitted by the USN are presented in Table 3. No active duty personnel costs were included in the cost submission presumably because the Navy considered the personnel costs as "sunk" and not part of the variable or incremental costs of the operation; personnel would be working on the ship whether they were responding to a disaster or not. The only personnel costs included were those for reserve or temporary duty personnel called up to support the HADR operation. The data for these costs are given in Table 3. For each vessel (name in the first column and platform in the second column) the table describes annual fuel and operating costs as well as daily fuel and operating costs. We summarize these in Table 4.

Table 3. Cost for Ships and Their Platforms for the 2004 Indian Ocean Tsunami

	PLATFORM	Enroute Days	Days O/S	Annual Fuel Costs*	Annual Operating Costs	Daily Fuel Costs	Daily Operating Costs
SHILOH	CG	8	32	28,020,983	69,734,655	76,770	191,054
BUNKER HILL	CG	4	20	12,603,547	67,858,359	34,530	185,913
ABRAHAM LINCOLN	CVN	8	32	0	290,674,704	0	796,369
BENFOLD	DDG	8	32	24,086,415	60,726,274	65,990	166,373
SHOUP	DDG IIA	8	32	24,360,927	57,176,568	66,742	156,648
MILIUS	DDG	4	20	13,591,382	60,109,785	37,237	164,684
THACH	FFG	4	20	6,957,373	37,994,241	19,061	104,094
SWIFT	HSV	27	33	5,123,411	11,692,310	14,037	32,034
WESTPAC EXPRESS	HSV	5	36	8,183,415	21,876,449	22,420	59,935
BONHOMME RICHARD	LHD	4	23	35,926,109	209,878,152	98,428	575,009
ESSEX	LHD	5	17	31,970,153	186,983,673	87,589	512,284
DULUTH	LPD	4	23	11,895,428	44,069,970	32,590	120,740
RUSHMORE	LSD	4	23	10,724,924	70,395,426	29,383	192,864
FORT MCHENRY	LSD	3	23	10,107,608	46,137,601	27,692	126,404
LOUISVILLE	SSN	8	0	4,427	25,015,918	12	68,537
PASADENA	SSN	4	0	12,135	28,987,911	33	79,419
SAN JOSE	T-AFS	3	53	19,243,024	56,853,590	52,721	155,763
CONCORD	T-AFS	3	20	11,809,392	50,067,891	32,354	137,172
NIAGARA FALLS	T-AFS	3	13	14,251,408	63,596,616	39,045	174,237
JOHN MCDONNELL	T-AGS	9	16	1,433,731	12,209,381	3,928	33,450
MERCY	T-AH	18	47	12,688,238	59,363,088	34,762	162,639
1ST LT JACK LUMMUS	T-AK	4	19	6,382,660	48,011,957	17,487	131,540
MAJ. STEPHEN W. PLESS	T-AK	2	19	18,817,120	56,256,994	51,554	154,129
CPL. LOUIS J. HAUGE JR	T-AK	4	12	8,287,218	47,929,956	22,705	131,315
PFC. JAMES ANDERSON	T-AK	2	11	7,126,549	44,371,080	19,525	121,565
1ST LT. HARRY L. MART	T-AK	0	13	6,464,093	36,055,194	17,710	98,781
1ST LT ALEX BONNYMA	T-AK	4	18	8,470,399	48,113,801	23,207	131,819
TIPPECANOE	T-AO	0	26	13,801,293	41,628,842	37,812	114,052
RAINER	T-AOE	8	32	25,066,234	72,986,245	68,675	199,962
* all costs in FY2015 US$							

Table 4. USN-Reported Incremental Costs Associated With the 2004 Indian Ocean Tsunami Operations off the Coast of Sumatra

USN Reported Incremental Costs (*in thousands of 2015 dollars*)	
Travel costs *(to move people into and within the region)*	$252
Reserve and Temporary Duty Personnel Support Costs	$1,745
Humanitarian Relief *(infrastructure support & supplies)*	$818
Operating Support *(includes ship steaming days and flying hours)*	$66,384
Total Reported Costs	**$69,198**

2010 Haiti Earthquake

In January 2010, a magnitude 7.0 earthquake struck southern Haiti from an epicenter 10 miles southwest of the capital city, Port-au-Prince. Within days of the earthquake, the USN provided 20 ships including one aircraft carrier, one hospital ship, and seven amphibious ships. The relief was provided by Marine Corps and various units for construction engineering, explosive ordnance disposal, mobile diving and salvage, underwater construction, medical, civil affairs, and others. The engagement from ship- and land-based aircraft was equally massive. Surveillance aircraft surveyed the damage caused by the earthquake. Fixed-wing planes helped with delivery of cargo to satisfy the demand and assisted in evacuations. Helicopters provided the vertical lift capacity critical to operating in an area without functioning infrastructure. The USN and U.S. Marine Corps committed a total of 14 fixed-wing aircraft and 63 helicopters.

The aid provided by the United States government in fiscal year (FY) 2010 totaled $1.12 billion (Ures, 2011). Over $453.5 million of the total funding represented the incremental cost to the DoD. Approximately $151 million in incremental costs (or $168 million in 2015 dollars) were submitted by the Navy for reimbursement. The data for these costs are given in Table 5. For each vessel (name in the first column and platform in the second column) the table describes annual fuel and operating costs as well as daily fuel and operating costs. We summarize these in Table 6.

Table 5. Cost for Ships and Their Platforms for 2010 Haiti Earthquake

	Platform	Days Enroute	Days O/S	Annual Fuel Costs*	Annual Operating Costs	Daily Fuel Costs	Daily Operating Costs
NORMANDY	CG	5	18	18,472,617	65,713,974	50,610	180,038
BUNKER HILL	CG	0	15	12,839,640	53,594,779	35,177	146,835
CARL VINSON	CVN	2	17	0	380,653,676	0	1,042,887
HIGGINS	DDG	2	12	7,634,307	54,045,513	20,916	148,070
HUAKAI	HSV	4	27	8,980,487	37,138,529	24,604	101,749
UNDERWOOD	FFG	1	20	7,087,674	31,243,662	19,418	85,599
NASSAU	LHA	5	17	41,041,984	149,344,468	112,444	409,163
BATAAN	LHD	4	65	26,634,038	159,775,128	72,970	437,740
KEARSARGE	LHD	1	0	22,877,905	177,470,565	62,679	486,221
MESA VERDE	LPD	5	17	13,653,604	56,231,411	37,407	154,059
FORT McHENRY	LSD	4	51	3,024,109	175,472,604	8,285	480,747
CARTER HALL	LSD	3	42	10,809,590	61,707,000	29,615	169,060
GUNSTON HALL	LSD	3	24	7,697,420	57,324,994	21,089	157,055
ASHLAND	LSD	5	17	12,410,197	71,413,530	34,001	195,654
CORNHUSKER STATE	T-ACS	10	42	946,486	3,139,111	2,593	8,600
GOPHER STATE	T-ACS	3	9	622,292	1,894,725	1,705	5,191
HENSON	T-AGS	0	11	4,130,014	16,624,883	11,315	45,548
COMFORT	T-AH	7	49	4,490,374	36,791,862	12,302	100,800
1ST LT JACK LUMMUS	T-AK	6	15	8,785,619	42,392,055	24,070	116,143
PFC DEWAYNE T. WILLIAMS	T-AK	4	28	5,080,970	28,210,371	13,920	77,289
SACAGAWEA	T-AKE	14	14	13,267,952	61,444,074	36,351	168,340
LEWIS AND CLARK	T-AKE	6	18	12,461,942	59,827,892	34,142	163,912
CAPE MAY	T-AKR	4	44	2,361,313	5,907,342	6,469	16,184
BIG HORN	T-AO	5	20	8,499,238	45,025,314	23,286	123,357
LEROY GRUMMAN	T-AO	11	4	7,954,483	41,377,929	21,793	113,364
GRASP	T-ARS	5	61	1,472,911	17,696,781	4,035	48,484
CARIBE PIONEER/FOSS 343	TUG	1	22	59,774	693,549	164	1,900
ELSBETH II/BB-110	TUG	1	38	170,023	1,567,758	466	4,295
ALLIE B/MEMPHIS BRIDGE	TUG	0	15	188,192	778,381	516	2,133
McALLISTER BOYS/ATLANTIC TRADE	TUG	7	15	126,261	1,091,562	346	2,991
* all costs in FY2015 US$							

Table 6. USN-Reported Incremental Costs Associated With the 2010 Haiti Earthquake Operations

USN Reported Incremental Costs (in thousands of 2015 dollars)	
Travel costs *(to move people into and within the region)*	$1,622
Active Personnel Costs	$37,650
Reserve and Temporary Duty Personnel Support Costs	$7,006
Humanitarian Relief *(infrastructure support & supplies)*	$19,931
Operating Support *(includes ship steaming days and flying hours)*	$102,118
Total Reported Costs	**$168,327**

2011 Tōhoku Earthquake in Japan

In March 2011, the Tōhoku earthquake and tsunami triggered overwhelming destruction and loss that resulted in an immediate global impact. The Tōhoku

earthquake resulted in over $200 billion in economic damage. The USN has approximately 70 ships, 300 various types of aircraft, and approximately 40,000 sailors and Marines operating in the region on any given day, providing a ready and capable presence. Sixteen U.S. naval ships and eight military sealift ships provided disaster relief in and around the affected coastal areas of Japan. Military sealift ships were engaged in relief supply transfer to responding U.S. naval ships. U.S. naval ships engaged in operations such as search and rescue, relief supply delivery on shore, and aircraft refueling operations. All services from the DoD assisted with medical supplies and services, communications, relief supply, and civil engineering.

The United States Pacific Command estimated total costs incurred from March 12, 2011, through June 30, 2011, to be approximately $2.89 billion in 2015 dollars (see Table 8). These costs included the cost of moving personnel (including DoD civilians) into and within the region ($8.7 million); reserve and temporary duty personnel support costs for those called up specifically for the disaster response ($334.9 million); humanitarian relief support, which included specific infrastructure and supply costs ($297.4 million); and operating support costs, which included ship steaming days and flying hour costs, and which make up the largest part of the total costs (approximately $2.25 billion). The data for these costs are given in Table 7. For each vessel (name in the first column and platform in the second column), the table describes annual fuel and operating costs as well as daily fuel and operating costs. We summarize these in Table 8.

Table 7. Cost for Ships and Their Platforms for 2011 Tōhoku Earthquake and Tsunami in Japan

	Platform	Days Enroute	Days O/S	Annual Fuel Costs*	Total Annual Cost	Daily Fuel Cost	Daily Operating Cost
CHANCELLORSVILLE	CG	1	22	27,309,174	69,690,477	74,820	190,933
COWPENS	CG	2	21	17,938,439	71,164,853	49,146	194,972
SHILOH	CG	2	21	4,898,678	72,823,479	13,421	199,516
RONALD REAGAN	CVN	1	22	0	346,279,612	0	948,711
GEORGE WASHINGTO	CVN	0	0	0	439,467,488	0	1,204,021
PREBLE	DDG IIA	1	22	17,624,283	80,226,310	48,286	219,798
MUSTIN	DDG IIA	2	21	16,392,195	55,375,623	44,910	151,714
MCCAMBLE	DDG IIA	0	24	15,533,788	65,499,045	42,558	179,449
JOHN MCCAIN	DDG	1	22	11,025,298	50,546,145	30,206	138,483
CURTIS WILBUR	DDG	1	23	11,485,218	49,455,930	31,466	135,496
FITZGERALD	DDG	1	22	16,246,998	63,810,109	44,512	174,822
ESSEX	LHD	6	22	24,853,098	151,471,561	68,091	414,991
GERMANTOWN	LSD	6	22	7,873,809	46,270,809	21,572	126,769
HARPERS FERRY	LSD	6	22	2,361,519	152,970,226	6,470	419,097
TORTUGA	LSD	3	25	5,698,340	51,348,731	15,612	140,681
BLUE RIDGE	LCC	7	22	12,320,072	98,492,118	33,754	269,841
RICHARD E BYRD	T-AKE	0	6	17,329,636	51,350,236	47,478	140,686
CARL BRASHEAR	T-AKE	1	14	14,635,129	52,597,508	40,096	144,103
MATTHEW PERRY	T-AKE	3	20	13,309,080	45,177,029	36,463	123,773
PECOS	T-AO	0	17	3,626,625	33,412,203	9,936	91,540
RAPPAHANNOACK	T-AO	0	23	8,059,244	37,353,476	22,080	102,338
BRIDGE	T-AOE	1	22	21,661,876	63,547,769	59,348	174,103
SAFEGUARD	T-ARS	10	15	1,848,331	14,959,099	5,064	40,984
WESTPAC EXPRESS	HSV	1	7	10,002,451	22,087,524	27,404	60,514
* all costs in FY2015 US$							

Table 8. USN-Reported Incremental Costs Associated With the 2011 Tōhoku Earthquake and Tsunami in Japan

USN Reported Incremental Costs (*in thousands of 2015 dollars*)	
Travel costs *(to move people into and within the region)*	$8,712
Reserve and Temporary Duty Personnel Support Costs	$334,950
Humanitarian Relief *(infrastructure support & supplies)*	$297,403
Operating Support *(includes ship steaming days and flying hours)*	$2,254,649
Total Reported Costs	**$2,895,714**

Summary and Future Research

Particularly in these times of budget cuts, realignment of forces, and restructuring of the Services, it is essential to study HADR operations—one of the USN's core capabilities—for at least two reasons: (1) to understand how the cost impacts of these "other than war" missions affect the DoD budget, and (2) a rough of order of magnitude (RoM) of the costs will benefit other organizations involved in humanitarian operations in case the USN decides to significantly curtail its HADR missions. We summarized the data from selected past disasters to organize their costs to propose future studies that can provide operational and financial policy recommendations that will induce efficiency and effectiveness.

Our report organizes the data from the available studies for 2004 Indian Tsunami, 2010 Haiti earthquake, and Tōhoku earthquake and tsunami of 2011 in Japan and provides a synopsis of each of these disasters which identifies the specific characteristics of the disaster, as well as the response time and USN assets used during the response.

There have been several important and useful studies of disaster responses. However, not many have examined and inventoried the specific relief provided, and even fewer that we are aware of have examined the costs. We recommend a future study that, in addition to summarizing the key cost analysis and cost estimation work of USN HADR operations, will also research which particular operations are the drivers of these costs. This analysis is not only of benefit to the USN but also other national military organizations and humanitarian organizations for the reasons stated earlier.

Future studies could include further exploration of avenues for collecting data from other sources that may have financial or operational information regarding the USN responses. Such research will help explain the primary drivers (cost elements) of the total costs associated with the USN responses. A study that digs deeper to uncover the costliest USN operations could reveal the cost drivers of HADR missions as well as which assets of the USN are used for such operations. Such assets are of importance to HADR operations. The study would help the USN make decisions regarding the acquisition of these assets or, in the case of assets that have been mothballed, the USN might determine to bring them back to functionality.

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